their bending stiffness is on the order of, and resists, the Brownian forces that randomize their conformation. The study of the collective dynamics of semi-flexible assemblies has come to prominence because it underlies the physics of force-transmission and mechanotransduction in cells and tissues. We had previously proposed modeling a semiflexible filament as a string of beams that bend continuously under Brownian forces (Chandran et al, 2009). This idealization not only captures the high-order nonlinear bending of the filament, but it does so at reduced computational cost compared to current string-of-beads idealizations. We had also proposed solving the relative solvent velocity along the filament as an implicit variable; which is equivalent to including several orders of hydrodynamic interaction and solvent-back reflection in the polymer dynamics (Chandran et al, 2010). In this presentation we compare the predictions of the string-of-beams model with implicit hydrodynamics against that of string-of-beads approaches for new insight on semiflexible polymer dynamics that is produced by the higher-order bending and interaction terms.

2447-Pos Board B584

Characterizing the Polyethylenimine Polymer Dynamics as a pH Buffer for its use as DNA Aggregating Agent

Danielle N. Miller, Quentinn Roby, Preethi L. Chandran, Kimberly Curtis.
Howard University, Washington, DC, USA.

In recent years Polyethylenimine (PEI), a positively charged polymer, has gained much attention for its use as a DNA complexing agent. The PEI charge comes from the protonation of tertiary amine groups on its backbone. Since about 50% of the amines are still protonable at physiological pH, the polymer can act like a buffering agent. This buffering property protects the DNA-PEI complex in the acidic environment of cell-uptake vesicles. From a polymer biophysics perspective, PEI is a hydrophobic, semi-flexible, weak-base polyelectrolyte; it remains in equilibrium with an aggregated phase and the free polymer dynamics is governed by competing intra-and inter-chain charge repulsion. We examined the role of PEI polymer biophysics in its biologically-important function as a pH buffering agent. Using Dynamic Light Scattering, the change in the PEI backbone elongation and its aggregation state was visualized as a function of H^+ addition to the backbone. Separate concentration regimes were examined for intra- and inter-chain charge repulsion. We report an interesting interplay between PEI charging and monomer aggregation occurring during the pH buffering.

2448-Pos Board B585

Interactions of Cell Surface Glycoproteins

Komitige H. Perera[1], Preethi L. Chandran[2].
[1]Biochemistry and Molecular Biology, Howard University, Washington, DC, USA, [2]Chemical Engineering, Howard University, Washington, DC, USA.

Cell surfaces are coated with glycoproteins and glycolipids. It is shown that carbohydrates present on cell surfaces offer a potential low affinity binding sites that act as diverse carbohydrate-carbohydrate recognition systems. Weak interactions between carbohydrate molecules allow the cells to test surrounding surfaces prior to establishing more stable covalent bonds. Carbohydrate-Carbohydrate interactions on cell surfaces play important roles in various biological processes such as cell trafficking, host-pathogen interactions, embryogenesis, spermatogenesis, implantation, cancer progression and angiogenesis. To further analyze the interactions between carbohydrates in biological systems, we are investigating the force-spectroscopy of mannobiosylated BSA on coated AFM surfaces. We present the effect of the oligosaccharide conformation and salt dependence on the glycoprotein interactions.

2449-Pos Board B586

Effect of Poly-Ethylenimine Dynamics on DNA Nanoparticle Packing

Paul A. Millard, Preethi L. Chandran.
Department of Chemical Engineering, Howard University, Washington, DC, USA.

Polyethylenimine (PEI) has been demonstrated as an alternative vector of gene delivery to targeted cells. Its cationic properties are effective in neutralizing the anionic properties of DNA and causes the DNA to be compacted into nanometer size particles. In this compact form, DNA can easily be transported into the cells for molecular biology studies, drug delivery applications and possibly genetic therapy. PEI also possesses pH buffering capabilities, which are necessary for the stability of DNA nanoparticles in the acidic environment of cell vesicles, and for the release of these nanoparticles into the cell's cytoplasm and subsequently the nucleus.

Since PEI is a hydrophobic weak-base polyelectrolyte, it switches between regimes of interchain and intra-chain charge repulsion as a function of salt and polymer concentrations. Its hydrophobic nature also causes aggregated phases to co-exist in solution. It is not known how the PEI polyelectrolyte regime alters its interactions with DNA and therefore the packing of DNA-PEI complexes. We investigate the effect of PEI polyelectrolyte dynamics on the coarse packing of DNA-PEI complexes by complementary solution studies with Dynamic Light Scattering and surface studies with Atomic Force Microscopy. We show that the PEI state changes the size, morphology, packing density, and nanomechanics of the DNA-PEI complex. We also present how oligosaccharide grafting alters the packing of the DNA-PEI complex.

2450-Pos Board B587

Bio-Inspired pH Responsive Hydrogels for Programmed Activation of Electrochemical Storage Systems in Biology

Nateé Johnson[1], Young Jo Kim[2], Hangjun Dingh[3], Philip LeDuc[1], Christopher Bettinger[2].
[1]Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA, USA, [2]Materials Science and Engineering, Carnegie Mellon University, Pittsburgh, PA, USA, [3]Chemistry, Carnegie Mellon University, Pittsburgh, PA, USA.

Bioinspired materials are often ideally suited for applications that are biologically integrated due to naturally evolved advantageous characteristics. One area where this is particularly important is in electrochemical storage materials that use aqueous electrolytes which are amenable for applications ranging from biomedical devices to grid-scale storage. Hygroscopic ionomer electrolytes permit fine control over the transport of cations using various mechanisms. Smart bioinspired polymers could enable spontaneous control of electrochemical discharge for use in the active control of battery operation. Here we present the design, fabrication, and characterization of pH-sensitive hydrogels that are bioinspired as polymeric electrolytes that can control the discharge of aqueous sodium-ion batteries. Poly(acrylic acid)-based hydrogels are used as electrolytes in combination with activated carbon anodes and manganese oxide cathodes. pH-sensitive hydrogels exhibit mesh size transitions as the pH is adjusted from 1.5 to 7. Chemical control of hydrogel mesostructure permits selective discharge of the electrochemical cell in the ''off'' and ''on'' configuration, respectively. We report discharge times permitted in these two states while operating in galvanostatic conditions at 0.1C. pH-dependent discharge of electrochemical storage systems composed of bioinspired and biocompatible materials could serve as a passive control mechanism for battery operation in biologically relevant applications including ingestible electronic devices.

2451-Pos Board B588

Diffusing Colloidal Probes of Cell Surfaces

Gregg A. Duncan, Michael A. Bevan.
Chemical and Biomolecular Engineering, Johns Hopkins University, Baltimore, MD, USA.

To engineer nanoparticles for novel biosensing, diagnostic imaging, and drug delivery applications, the interactions of nanoparticles with the surface of cells must be characterized to better understand their influence on specific and non-specific cell surface adhesion, internalization pathways, and toxicity. In order to develop models to aid in optimization and design in these systems, direct measurements of colloidal interactions with cell surfaces are required that are both quantitative and sensitive to determine the impact of particle composition and surface chemistry. In this talk, we report the use of diffusing colloidal probes to directly measure cell surface interactions with kT-scale sensitivity with newly developed imaging and analysis techniques. Dark field video microscopy allows for label-free imaging of colloidal particles and live cells. With combined real-time particle tracking and cell boundary determination, particle trajectories can be monitored in relation to their distance from the cell surface which allows for direct measurement of equilibrium and non-equilibrium colloid-cell interactions. Using this technique, polymer, protein, and carbohydrate functionalized colloidal silica were used to measure specific and non-specific macromolecular interactions with the surface of epithelial breast cancer cells. Ultimately, our results demonstrate how diffusing colloidal probe microscopy can be used to characterize biomolecular and biophysical properties of cell surfaces.

2452-Pos Board B589

Archaeal Tetraether Free Standing Lipid Membranes in a PDMS and PCB based Fluidic Platform

Parkson Chong[1], Xiang Ren[2], Hongseok Noh[2], Caglan Kumbur[2], Wenqiao Yuan[3], Jack Zhou[2].
[1]Biochemistry, Temple University School of Medicine, Philadelphia, PA, USA, [2]Mechanical Engineering and Mechanics, Drexel University, Philadelphia, PA, USA, [3]Biological and Agricultural Engineering, North Carolina State University, Raleigh, NC, USA.

The polar lipid fraction E (PLFE) isolated from the thermoacidophilic archaeon *Sulfolobus acidocaldarius* contains exclusively bipolar tetraether lipids, which